Exhibit 3

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Georgiev

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(54) **RECESSED LIGHT-EMITTING DIODE LIGHTING FIXTURE**

(71) Applicant: **Georgi Yosifov Georgiev**, Delta (CA)

(72) Inventor: **Georgi Yosifov Georgiev**, Delta (CA)

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(51) **Int. Cl.**

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F21V 14/06	(2006.01)
F21V 29/77	(2015.01)
F21S 8/02	(2006.01)
F21V 17/02	(2006.01)
F21V 17/12	(2006.01)
F21V 21/26	(2006.01)

(Continued)

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CPC ***F21V 14/06*** (2013.01); ***F21S 8/026*** (2013.01); ***F21V 17/02*** (2013.01); ***F21V 17/12*** (2013.01); ***F21V 19/0055*** (2013.01); ***F21V 21/26*** (2013.01); ***F21V 21/30*** (2013.01); ***F21V 23/023*** (2013.01); ***F21V 23/06*** (2013.01); ***F21V 29/74*** (2015.01); ***F21V 29/77*** (2015.01); ***F21V 31/005*** (2013.01); *F21V 21/046* (2013.01); *F21V 29/76* (2015.01); *F21Y 2115/10* (2016.08)

(58) **Field of Classification Search**

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See application file for complete search history.

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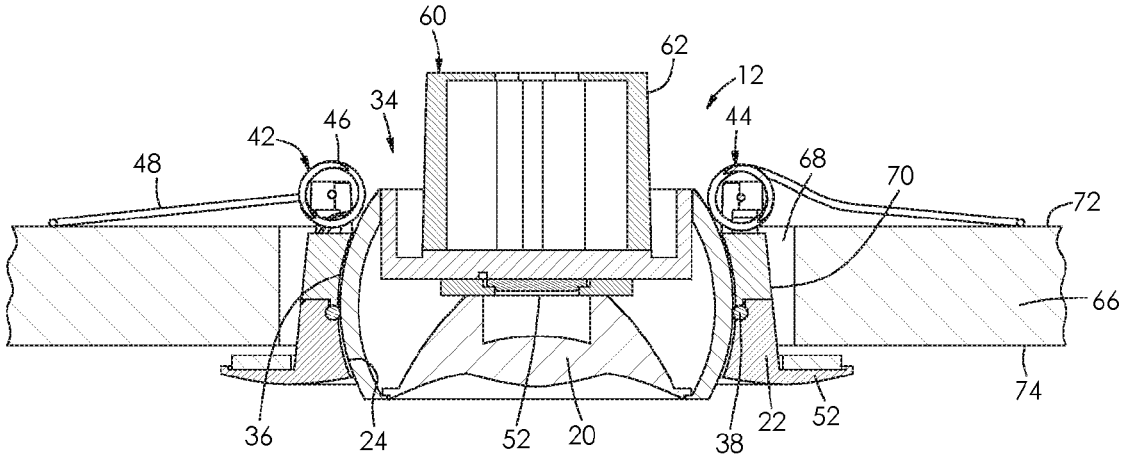
Primary Examiner — Gerald J Sufleta, II
(74) *Attorney, Agent, or Firm* — Cameron IP

(57) **ABSTRACT**

A recessed lighting fixture comprises a generally annular body having a central cavity in the form of a partially spherical socket. There is a lighting support member having a partially spherical exterior portion which is closely fitted within the partially spherical socket of the annular body. The lighting support member is pivotable relative to the annular body, but air flow between the partially spherical socket of the annular body and the partially spherical exterior portion of the lighting support member is substantially restricted. There may be a light source mounted to the lighting support member adjacent a bottom thereof. The light source may be a light-emitting diode.

16 Claims, 10 Drawing Sheets



(51) **Int. Cl.**

F21V 23/02	(2006.01)
F21V 23/06	(2006.01)
F21V 31/00	(2006.01)
F21V 19/00	(2006.01)
F21V 21/30	(2006.01)
F21V 29/74	(2015.01)
F21Y 115/10	(2016.01)
F21V 21/04	(2006.01)
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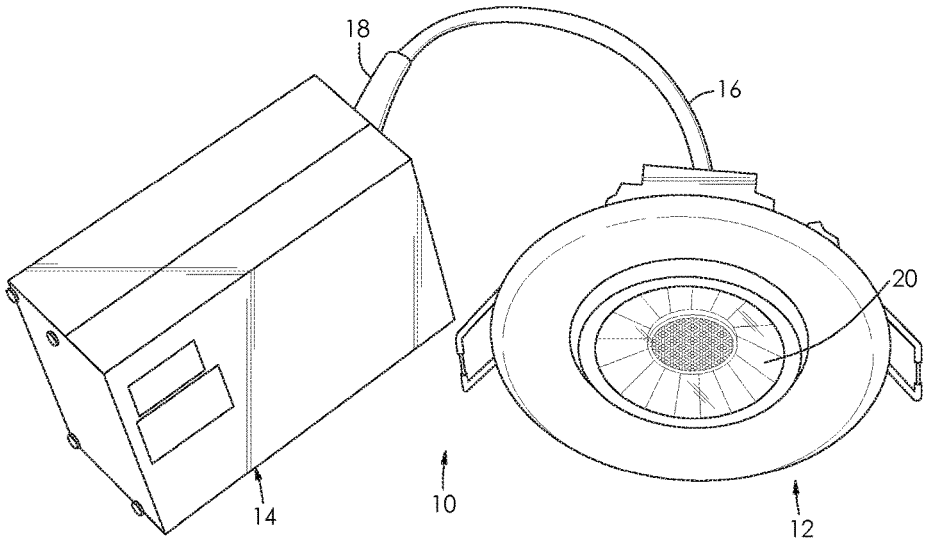

FIG. 1

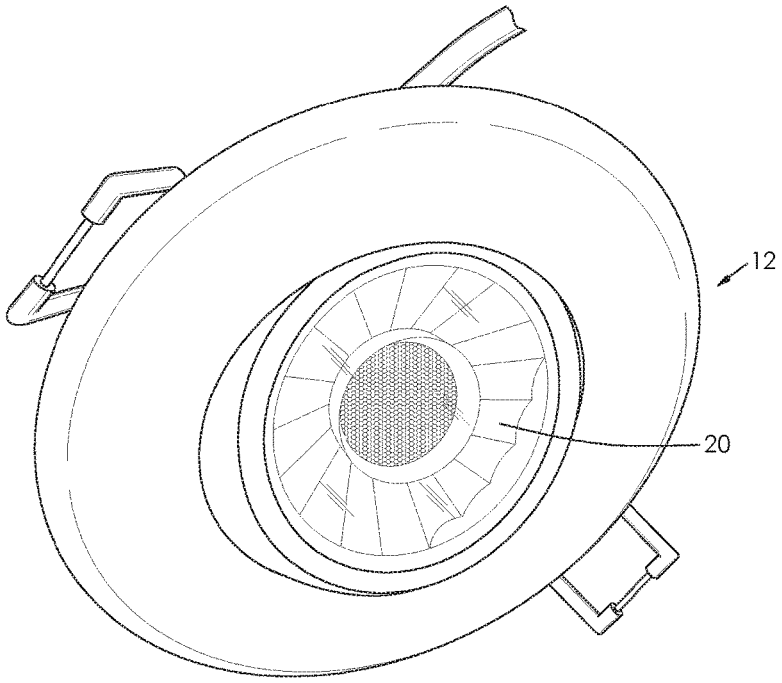

FIG. 2

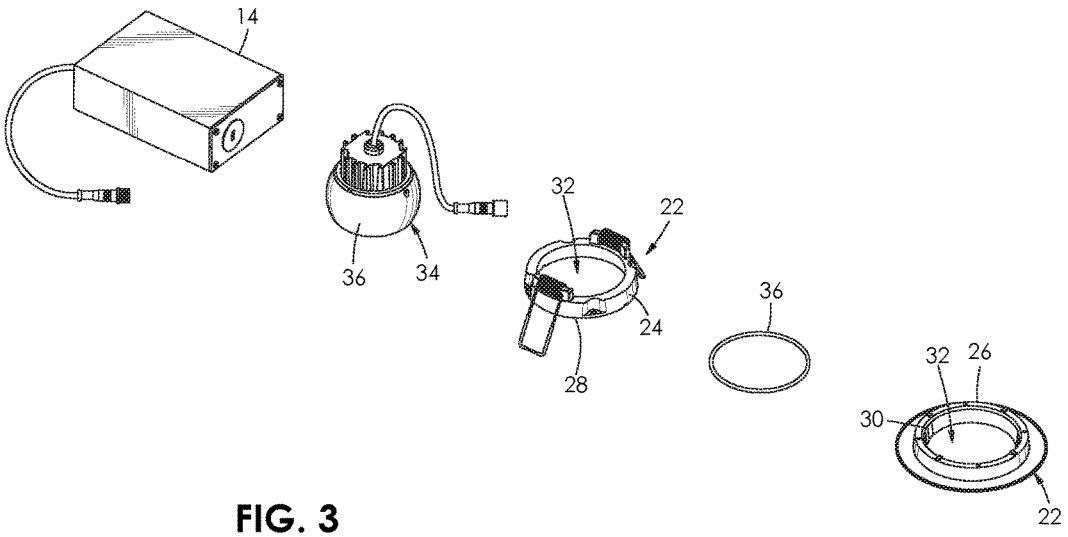

FIG. 3

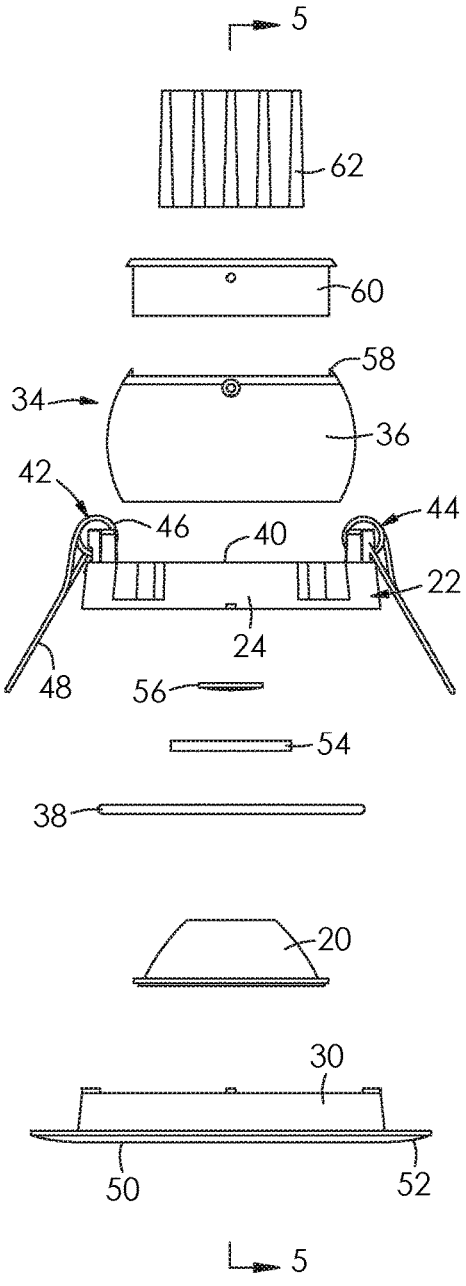
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FIG. 4

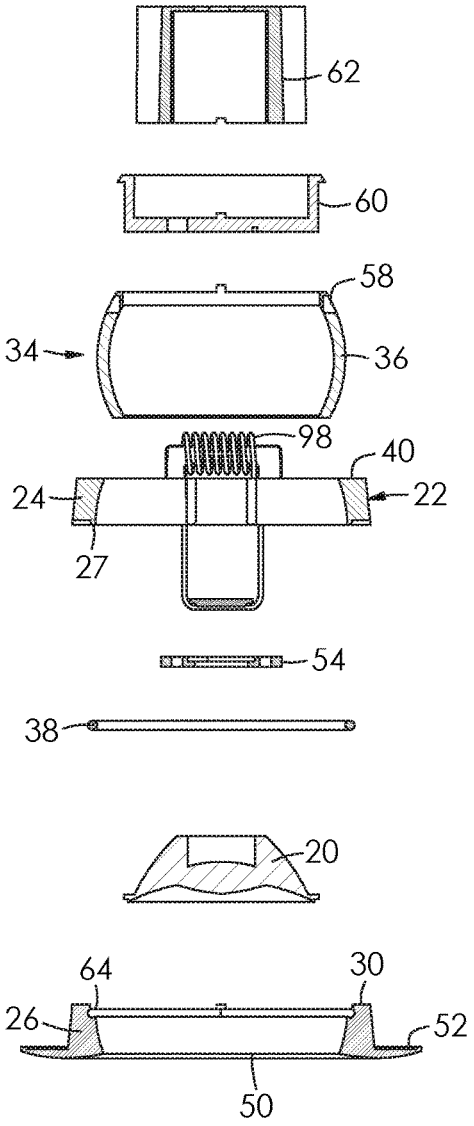
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FIG. 5

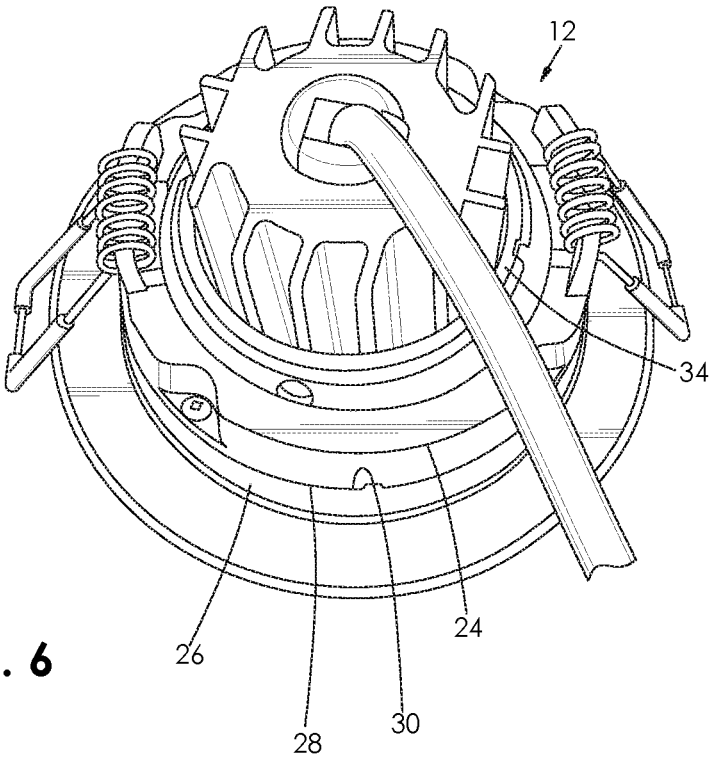

FIG. 6

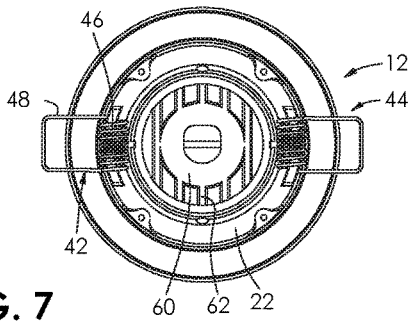

FIG. 7

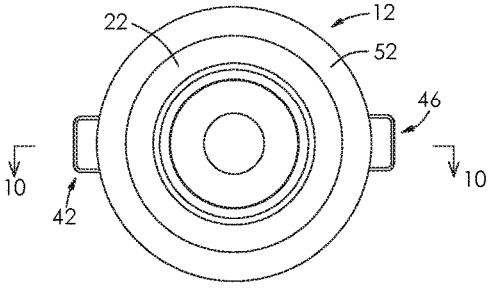

FIG. 8

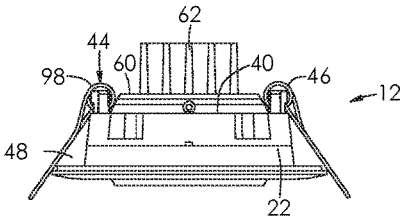

FIG. 9

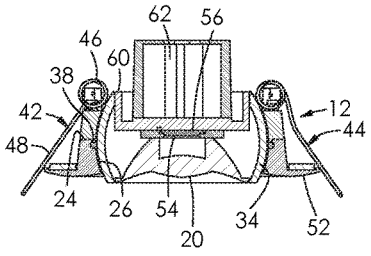

FIG. 10

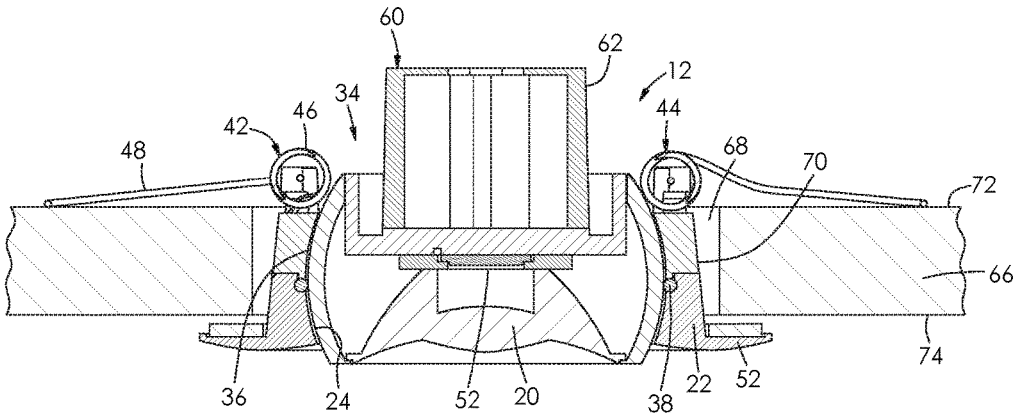

FIG. 11

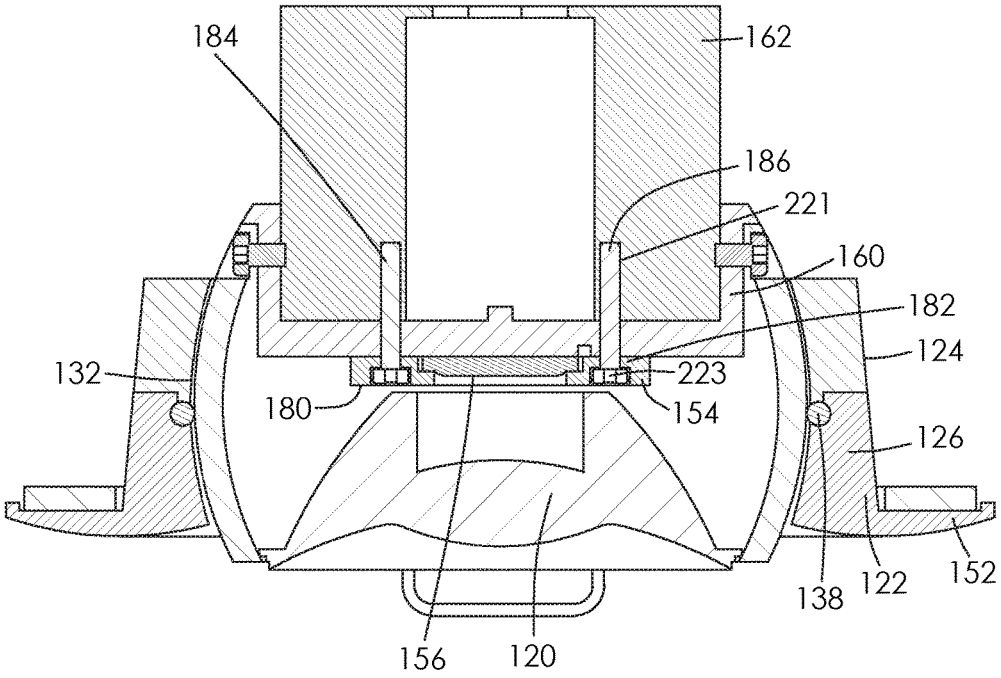
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FIG. 12

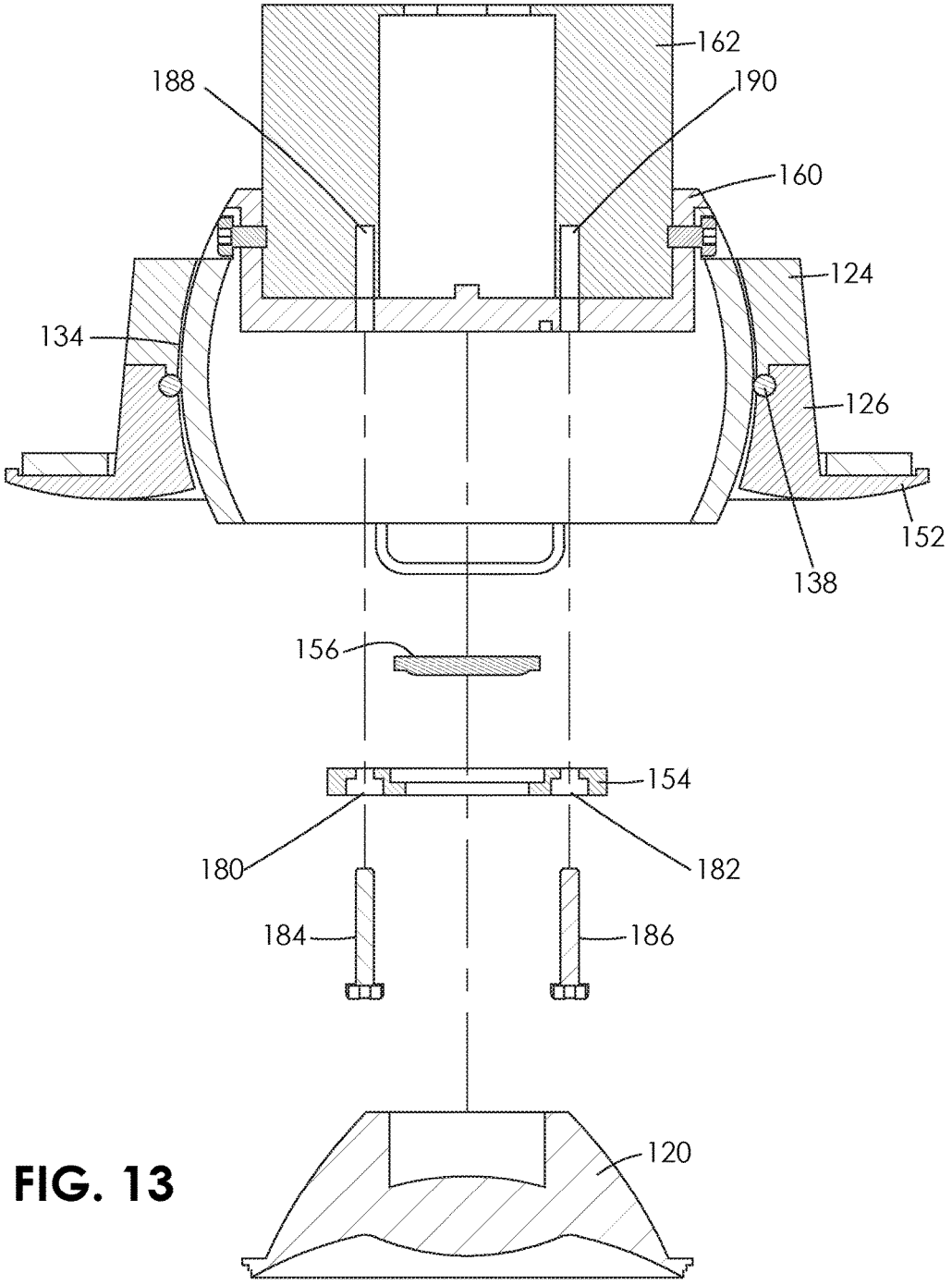

FIG. 13

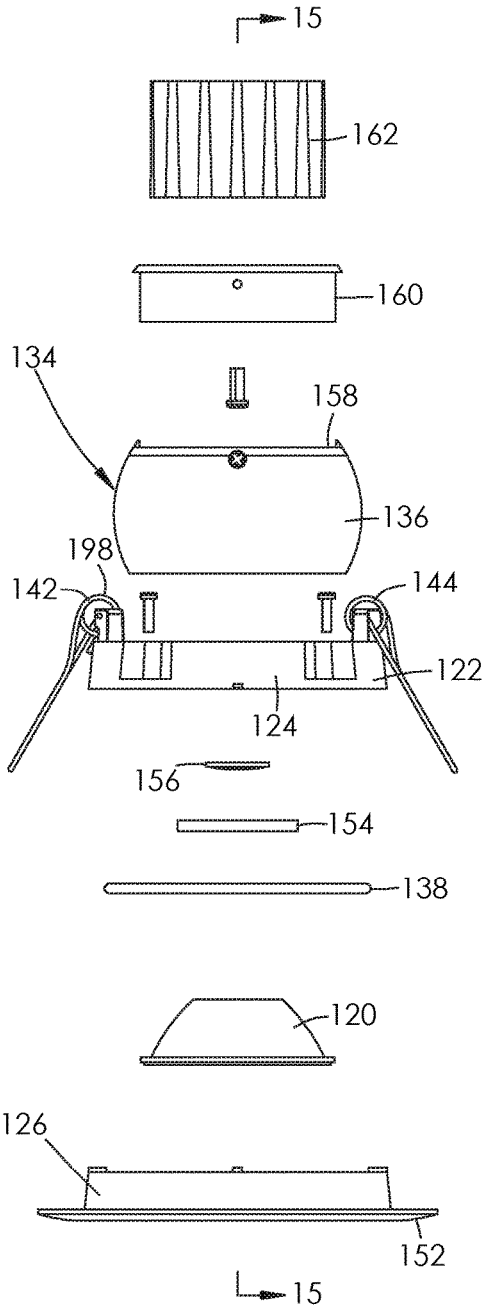
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FIG. 14

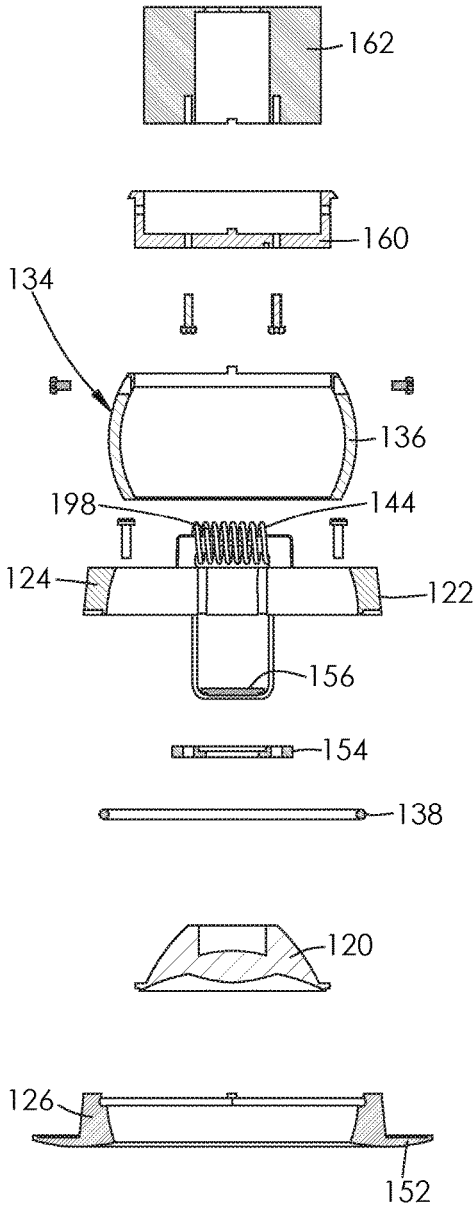
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FIG. 15

RECESSED LIGHT-EMITTING DIODE LIGHTING FIXTURE

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to lighting fixtures and, in particular, to recessed lighting fixtures for light-emitting diode (LED) lighting.

Description of the Related Art

It is known to provide buildings with recessed light-emitting diode (LED) lighting fixtures. This typically includes providing an LED lighting fixture mounted flush with the exterior of the ceiling. The LED lighting fixture extends through an aperture in the ceiling. A metal box is normally mounted on the interior of the ceiling above the aperture for the LED lighting fixture. A power supply for the lighting fixture may be mounted on the metal box. Considerable installation work is accordingly involved if the ceiling is to be retrofitted with such fixtures. A large opening has to be made to fit the box and thereafter the ceiling has to be replaced to cover the bottom of the box apart from the aperture for the lighting fixture.

It is also desirable for many purposes to allow the lens of the LED lighting fixture to be pivoted to a desired angle to illuminate specific things in a room, for example, artwork. Pivoting may be also required when the LED lighting fixture is mounted on, for example, an angled ceiling or wall. However, conventional LED lighting fixtures which allow pivoting of the lens have gaps between the lens and the annular body of the fixture in order to accommodate pivoting.

LED lighting fixtures have been developed which do not require a separate metal box, but instead are connected to a sealed power supply via an electrical conductor. The power supply for such units can simply be positioned on the interior of the ceiling without requiring a fixed type of mounting. This considerably simplifies the difficulty and cost of installing LED lighting fixtures, particularly for existing buildings.

However, LED lighting fixtures of the type not requiring a metal box usually have the bottom of the lens in a fixed, horizontal position. This is because it is undesirable to allow air flow through the LED lighting fixtures since this may cause considerable heat loss through the ceiling. Metal boxes are accordingly mounted above the fixtures in order to prevent air flow through the ceiling.

SUMMARY OF THE INVENTION

There is provided, according to the invention, a recessed lighting fixture comprising a generally annular body having a central cavity in the form of a partially spherical socket. There is a lighting support member having a partially spherical exterior portion which is closely fitted within the partially spherical socket of the annular body. The lighting support member is pivotable relative to the annular body. Air flow between the partially spherical socket of the annular body and the partially spherical exterior portion of the lighting support member is substantially restricted. There may be a light source mounted to the lighting support member adjacent a bottom thereof. The light source may be a light-emitting diode.

The lighting fixture may include a resilient, annular seal which sealingly extends between the partially spherical exterior portion of the lighting support member and the partially spherical socket of the annular body. The seal may be an annular O-ring. The O-ring may be of silicone.

The lighting fixture may include spring-loaded members connected to the annular body adjacent to a top thereof and extending outwardly therefrom. The spring-loaded members may be configured to resiliently contact an upper, interior surface of a ceiling. Each of the spring-loaded members may include a coil spring mounted on the lighting support member and an outwardly extending arm connected to the coil spring.

The lighting fixture may have an outwardly extending annular flange adjacent a bottom of the annular body for fitting over an exterior surface of a ceiling. The lighting fixture may include a heat sink mounted on the lighting support member adjacent a top thereof.

There is also provided, according to the invention, a recessed lighting assembly comprising a recessed lighting fixture having a generally annular body with a central cavity in the form of a partially spherical socket. The lighting fixture also includes a lighting support member having a partially spherical exterior portion which is closely fitted within the partially spherical socket of the annular body. The lighting support member is pivotable relative to the annular body, but air flow between the partially spherical socket of the annular body and the partially spherical exterior portion of the lighting support member is substantially restricted. The lighting assembly further includes a power supply module and an electrical conductor connecting the lighting fixture to the power supply module. There may be a light source mounted to the lighting support member of the lighting fixture adjacent a bottom thereof. The light source may be a light-emitting diode.

BRIEF DESCRIPTIONS OF DRAWINGS

The invention will be more readily understood from the following description of the embodiments thereof given, by way of example only, with reference to the accompanying drawings, in which:

FIG. **1** is a bottom, side isometric view of a lighting assembly including a lighting fixture and a power supply connected thereto by an electrical conductor;

FIG. **2** is a bottom, side isometric view of the lighting fixture of FIG. **1** with a lens thereof shown in a tilted position;

FIG. **3** is an exploded, side isometric view of the lighting fixture of FIG. **1**;

FIG. **4** is an exploded, side elevational view of the lighting fixture of FIG. **1**;

FIG. **5** is an exploded, side elevational view of the lighting fixture of FIG. **1** taken along lines **5-5** of FIG. **4**;

FIG. **6** is a top, side isometric view of the lighting fixture of FIG. **1** showing a heat sink and spring-loaded members thereof;

FIG. **7** is a top, plan view of the lighting fixture of FIG. **1**;

FIG. **8** is a bottom plan view of the lighting fixture of FIG. **1**;

FIG. **9** is a side, elevational view of the lighting fixture of FIG. **1**;

FIG. **10** is a side, sectional view of the lighting fixture of FIG. **1** taken along lines **10-10** of FIG. **8**;

FIG. **11** is a side, sectional view showing the light fixture mounted on a ceiling, with the ceiling being shown in fragment;

FIG. **12** is a side, sectional view of a lighting assembly according to an alternative embodiment of the invention;

FIG. **13** is a partially exploded view similar to FIG. **12** with the lens and light-emitting diode of the lighting assembly shown disassembled;

FIG. **14** is an exploded, side elevational view of the lighting fixture of FIG. **12**; and

FIG. **15** is an exploded, side sectional view of the lighting fixture of FIG. **12** taken along lines **15-15** of FIG. **14**.

DESCRIPTIONS OF THE SPECIFIC EMBODIMENTS

Referring to the drawings, and first to FIG. **1**, there is shown a lighting assembly **10**. The lighting assembly **10** includes a lighting fixture **12** which, in this example, is a light-emitting diode lighting fixture. The lighting fixture **12** is connected to a power supply module **14** by an electrical conductor **16** which is provided with a connector portion **18**. The connector portion **18** may be a two-pin socket. This general arrangement is known and the power supply and conductor are available, for example, from Lotus Invest Ltd DBA Lotus LED Lights which has a business address at 1080 Cliveden Ave, Unit 7 Delta, British Columbia, Canada, V3M 6G6. The lighting fixture **12** however offers significant advantages over conventional recessed lighting fixtures used previously in such assemblies. In particular, the lighting fixture **12** has a lens **20** which is gimbal mounted to permit tilting of the lens up to 30° in any desired direction. FIG. **2** shows the lens **20** tilted in one direction.

An exploded view of the lighting fixture **12** is best shown in FIG. **3**. The lighting fixture **12** includes an annular body **22** which has an upper portion **24** and a lower portion **26**. A bottom **28** of the upper portion **24** abuts a top **30** of the lower portion **26** when the lighting fixture **12** is assembled as shown, for example, in FIG. **6**. Referring back to FIG. **3**, the upper portion **24** and the lower portion **26** of the annular body **22** define a central cavity in the form of a partially spherical socket **32**. The annular body **22** is of metal in this example. The lighting fixture **12** also includes a lighting support member **34** which is also of metal in this example. The lighting fixture **12** has a partially spherical exterior portion **36**. The partially spherical exterior portion **36** of the lighting support member **34** is closely fitted within the partially spherical socket **32** of the annular body **22** when the lighting fixture **12** is assembled as shown, for example, in FIG. **10**. This permits pivoting of the lighting support member **34** relative to the annular body **22**. Referring back to FIG. **3**, there is also a flexible O-ring **38** which is disposed between the upper portion **24** and the lower portion **26** of the annular body **22** when the lighting fixture is assembled as shown, for example, in FIG. **10**. The O-ring **38** sealingly extends between the partially spherical socket **32** of the annular body **22** and the partially spherical exterior portion **36** of the lighting support member **34** when the lighting fixture **12** is assembled. This substantially restricts air flow between the partially spherical socket **32** of the annular body **22** and the partially spherical exterior portion **36** of the lighting support member **34**.

The annular body **22** has a top **40** as shown, for example, in FIGS. **4** and **5**, and a pair of spring-loaded members **42** and **44**. Each of these spring-loaded members, for example spring-loaded member **42**, includes a coil spring **46** mounted on the top **40** of the annular body **22**. An arm **48** is connected to the coil spring **46** and extends outwardly therefrom. The arm **48** is generally U-shaped and formed from wire. The annular body **22** also has a bottom **50** with an outwardly

extending annular flange **52** thereon adjacent the bottom **50** thereof. The lighting support member **34** has the lens **20** mounted thereon and a bracket **54** for receiving a light source which, in this example, is a light-emitting diode **56**. However, the light source may be different in other embodiments and may be, for example, a halogen light bulb. The lighting support member **34** has a top **58** with a heat sink **60** mounted thereon. The heat sink **60** has a plurality of cooling fins **62**.

In this example, the O-ring **38** is received within an annular groove **64**, best shown in FIG. **5**, extending about the lower portion **26** of the annular body **22** near the top **30** thereof. The O-ring **38** effectively seals the lighting fixture **12** and prevents air leakage therethrough when the lighting fixture is assembled as shown in FIGS. **7** to **10**. The O-ring **38** is silicone, in this example, but other suitable resilient materials could be substituted. Furthermore, other types of seals could be substituted for the O-ring **38** which would permit pivoting of the lighting support member **34** relative to the annular body **22**, while preventing the flow of air between the lighting support member **34** and the annular body **22**.

The lighting fixture **12** is installed by first cutting the ceiling **66**, shown in FIG. **11**, to form the aperture **68** which is circular in this example and slightly larger than exterior annular wall **70** on the annular body **22** above the flange **52**. The power supply module **14** is positioned on top of the interior surface **72** of the ceiling **66** and is connected to the lighting fixture **12** via the electrical conductor **16** and the connector portion **18** as shown in FIG. **1**.

The arms **48** of the spring loaded members **42** and **44** are configured to resiliently contact an upper, interior surface **72** of the ceiling **66** when the lighting fixture **12** is installed as shown in FIG. **11**. FIG. **6** show the arms **48** of the spring loaded members **42** and **44** in a non-deflected position prior to installation of the lighting fixture **12**. Thus, when the lighting fixture **12** is installed within the ceiling **66** as shown in FIG. **11**, the arms **100** are deflected and are resiliently biased against the interior surface **72** of the ceiling **66** to secure the lighting fixture in place with the flange **52** against an exterior surface **74** of the ceiling **66**.

The arms **48** of the spring-loaded members **94** and **96** are rotated upwardly and substantially vertically to positions near the cooling fins **62** so they can be inserted through the aperture **68** in the ceiling. The lighting fixture **12** is oriented with the flange **52** at the bottom and the lighting fixture **12** is then inserted upwardly through the aperture **68** with the arms **48** held in the raised positions until the arms are inserted through the aperture. The arms **48** can then be released and upward movement of the lighting fixture **12** is continued until the flange **52** contacts the exterior surface **74** of the ceiling **66**. When the arms **48** become aligned with the interior surface **72** of the ceiling **66**, the arms begin to move downwardly due to the resiliency of the coil springs **46** and continue to the generally horizontal positions shown in FIG. **11** where the arms **48** are pressed against the interior surface **72** of the ceiling and secure the lighting fixture **12** in place with the flange **52** pressed against the exterior surface **74** of the ceiling **66**. The flange **52** fits over the exterior surface **74** of the ceiling **66** with the annular body **22** extending through the aperture **68** in the ceiling **66**. The aperture is circular in this example.

FIGS. **11** to **14** show an alternative embodiment which is the same as the above embodiment except as described below. Like parts are given like numbers in the "100" series. In this embodiment, the bracket **154** is provided with a pair of apertures **180** and **182** extending therethrough, each of

which is configured for receiving a respective one of bolts **184** and **186**. The heat sink **160** is provided with corresponding threaded bores **188** and **190** which each threadedly receive a respective one of the bolts **184** and **186**. The bolts **184** and **186** can be removed along with the light-emitting diode **156** and bracket **154** as shown in FIG. **12** to allow the light-emitting diode to be replaced.

It will be understood by a person skilled in the art that many of the details provided above are by way of example only, and are not intended to limit the scope of the invention which is to be determined with reference to the following claims.

What is claimed is:

1. A recessed lighting fixture comprising:

a generally annular body having a central cavity in the form of a partially spherical socket;

a lighting support member having a partially spherical exterior portion fitted within the partially spherical socket of the annular body; and

an O-ring sealingly disposed between the partially spherical exterior portion of the lighting support member and the partially spherical socket of the annular body, whereby the lighting support member is pivotable relative to the annular body, but air flow between the partially spherical socket of the annular body, the partially spherical exterior portion of the lighting support member, and a ceiling is substantially restricted.

2. The recessed lighting fixture of claim **1**, wherein the lighting support member has a bottom and a light source is mounted to the lighting support member adjacent the bottom thereof.

3. The recessed lighting fixture of claim **2**, wherein the light source is a light-emitting diode.

4. The recessed lighting fixture of claim **1**, wherein the O-ring is made of silicone.

5. The recessed lighting fixture of claim **1**, wherein the annular body has a bottom, the lighting fixture having an outwardly extending annular flange adjacent the bottom of the annular body for fitting over an exterior surface of the ceiling.

6. The recessed lighting fixture of claim **1**, wherein the annular body has a top, the lighting fixture including spring-loaded members connected to the annular body adjacent to the top thereof and extending outwardly therefrom, the spring-loaded members being configured to resiliently contact an upper, interior surface of the ceiling.

7. The recessed lighting fixture of claim **6**, wherein each of the spring-loaded members includes a coil spring mounted on the lighting support member and an outwardly extending arm connected to the coil spring.

8. The recessed lighting fixture of claim **1**, wherein the lighting support member has a top, the lighting fixture including a heat sink mounted on the lighting support member adjacent the top thereof.

9. A recessed lighting fixture comprising:

a generally annular body having a central cavity in the form of a partially spherical socket;

a lighting support member having a partially spherical exterior portion fitted within the partially spherical socket of the annular body; and

an O-ring sealingly disposed between the partially spherical exterior portion of the lighting support member and the partially spherical socket of the annular body, whereby the lighting support member is pivotable relative to the annular body, but air flow between the partially spherical socket of the annular body, the partially spherical exterior portion of the lighting support member, and a ceiling is substantially restricted;

a power supply module; and

an electrical conductor connecting the lighting fixture to the power supply module.

10. The recessed lighting assembly of claim **9**, wherein the lighting support member has a bottom and a light source is mounted to the lighting support member adjacent the bottom thereof.

11. The recessed lighting assembly of claim **10**, wherein the light source is a light-emitting diode.

12. The recessed lighting fixture of claim **1**, wherein the O-ring is made of silicone.

13. The recessed lighting fixture of claim **9**, wherein the annular body has a bottom, the lighting fixture having an outwardly extending annular flange adjacent the bottom of the annular body for fitting over an exterior surface of the ceiling.

14. The recessed lighting fixture of claim **9**, wherein the annular body has a top, the lighting fixture including spring-loaded members connected to the annular body adjacent to the top thereof and extending outwardly therefrom, the spring-loaded members being configured to resiliently contact an upper, interior surface of the ceiling.

15. The recessed lighting assembly of claim **14**, wherein each of the spring-loaded members includes a coil spring mounted on the lighting support member and an outwardly extending arm connected to the coil spring.

16. The recessed lighting assembly of claim **9**, wherein the lighting support member has a top, the lighting fixture including a heat sink mounted on the lighting support member adjacent the top thereof.

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